Space Weather Technical Forecast

Issued on Friday, 11 November 2022 at 12:29 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of further M-class flares (R1-R2/Minor to Moderate radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with two M class flares from AR3141, the largest of which was an M1.2 flare at 11/0714 UTC. There are three numbered regions on the visible disc, with AR3141 remaining the most complex and largest of the regions and is classified as an Eki/Beta-Gamma-Delta. AR3140 also showed some development, and is now classified as Dso/Beta due to the emergence of rear penumbra. The remaining region, AR3145, is a weakening Axx/Alpha group.
No Earth-directed CMEs have been observed on available imagery.
Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1, persisted at background levels, with wind speeds generally varying between 300/340 km/s. Density showed a slight upward trend from average levels to just above average. Total magnetic field strength (IMF) has been predominantly weak, before increasing to around 10 nT late in the period. The north-south component, Bz, fluctuated between +9/-7 nT. Phi angle was initially negative (towards the Sun), before becoming mainly positive (away from the Sun). Geomagnetic activity was Quiet (Kp 0-2).
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2 MeV) at GOES-16 reached High levels at the peak of the diurnal cycle, 1334 pfu at 10/1915 UTC before declining back into background to moderate levels. Electron fluence levels remain well below Active levels. Observed fluence at 11/0001 UTC was 5e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be at Moderate levels, with further M-Class activity likely. Over the next few days, three returning active regions are due to potentially rotate across the limb. Therefore the probability of a significant flare may increase once the expected regions rotate onto the visible disc.
Solar Wind / Geomagnetic Activity: Geomagnetic activity is expected to be mainly Quiet to Unsettled (Kp 1-3). There is a slight chance of Active (Kp 4) intervals during the period. While there are no Earth-directed CMEs showing at the moment imagery will be monitored following the recent M-flares from a position on the disk where any CMEs may have an Earth-directed component.
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) observed by GOES-16 is expected to remain at background levels. Electron flux is forecast to be at background to moderate levels through the period, possibly just reaching High levels during diurnal peaks. Fluence values are likely to remain below Active through the remainder of the period.

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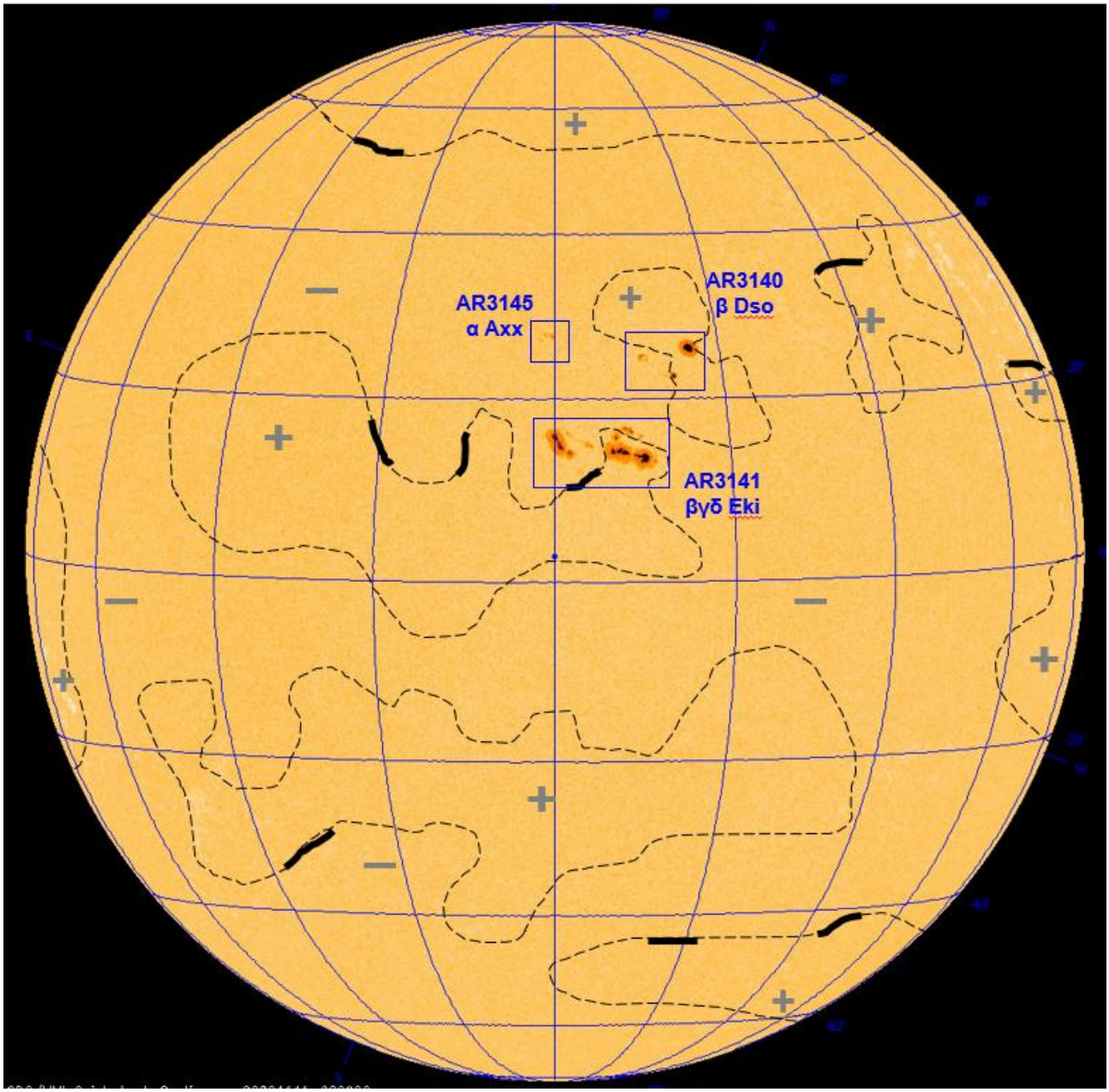
Figure 1. Solar Analysis Valid 11/0800UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are currently forecast. Though imagery will be monitored following the recent M-flares from a position on the disk where any CMEs may have an Earth-directed component.

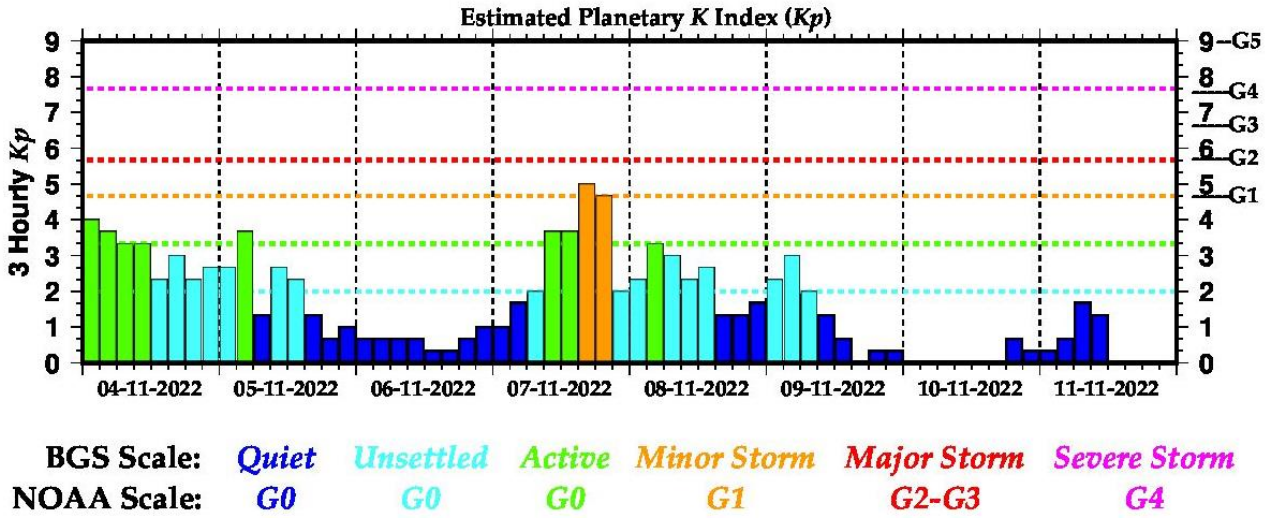
Solar winds are currently at slow-ambient levels. There are no coronal holes on the visible disk so winds are likely to remain at background levels. There remains a slight chance of a glancing blow from a transient solar wind feature at any time.

Geomagnetic activity is expected to be mainly Quiet to Unsettled. There is a slight chance of Active intervals during the period if weak transients do impact Earth.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections – Nil

Figure 2: BGS Kp index.



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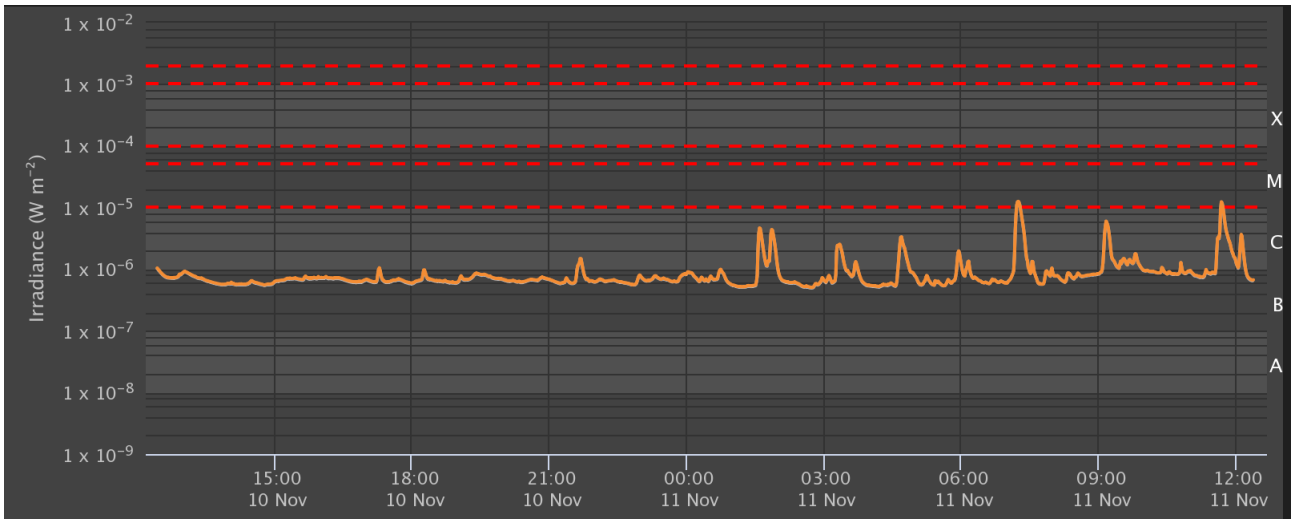
Radio Blackouts - X-Ray Flares:

Solar activity is expected to be at Moderate levels, with further M-Class activity, this most likely from complex region AR3141 Eki/Beta-Gamma-Delta. The remaining regions on the visible disc are far less likely to produce significant flares. Over the next few days, three returning active regions are due to potentially rotate across the limb. Therefore the probability of a significant flare may increase, once the expected regions rotate onto the visible disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	60	60	60
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: GOES16 X-Ray flares



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) at GEO, observed by GOES-16 is currently at background levels and is forecast to remain at this level throughout the period. As AR3141 moves into a more geoeffective position from 12 Nov, however, the probability of proton storms sees a very minor increase.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	2	2	2
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

Electron flux (greater than 2MeV) is currently at background to moderate levels. Electron flux is forecast to remain at moderate levels through the period, perhaps briefly exceeding high (1e3 pfu) during diurnal peaks.

Electron fluence values are below the Active (1e8 integrated pfu) threshold. While fluence levels are likely to rise, there is only a slight chance of the 1e8 Active threshold being breached. This is supported by the MOSWOC REF Model which is showing a slight increasing trend, albeit from lower levels than are being observed.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	20	20	20	20
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

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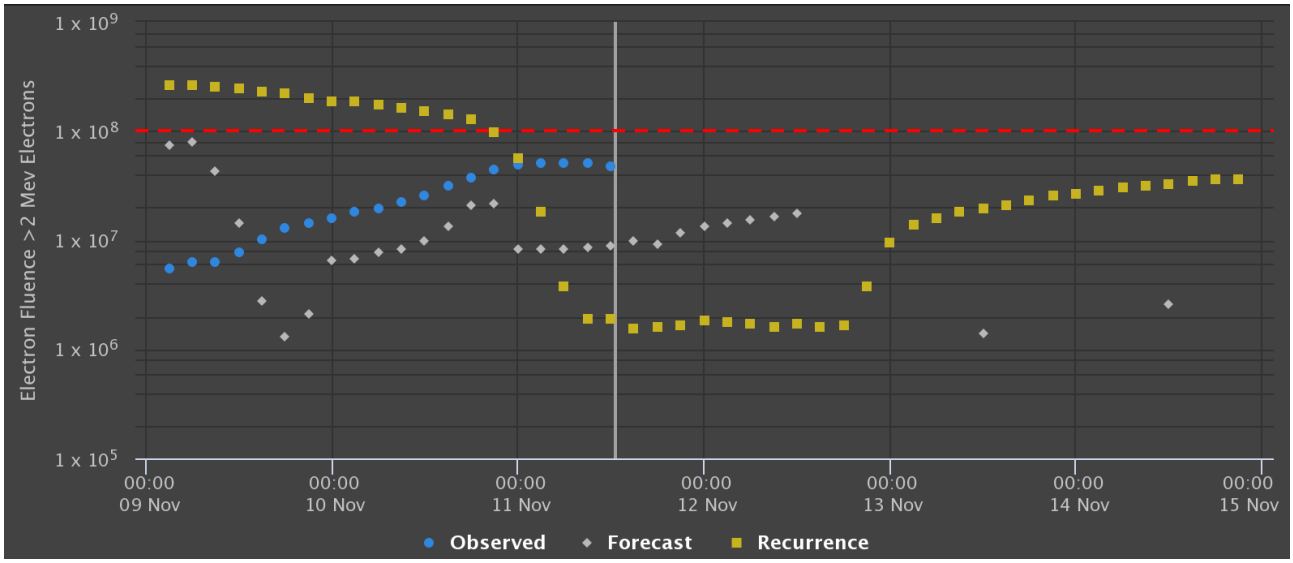
Figure 4: MOSWOC REF Model shows observed integrated fluence values above the forecast levels, but now on a steady trend.



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